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PARALYSIS OF THE FACIAL NERVE.

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PARALYSIS OF THE FACIAL NERVE.

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Paralysis of the facial nerve (portio-dura of the seventh pair) is characterised by loss of motion in the corresponding half of the face, while the sensibility is retained. This nerve then ought to be regarded as purely motor, a fact established in science and admitted by the generality of physiologists of the present day. If, however, in a great number of cases, the lesion of the facial nerve is marked by disorder of mobility, it very often happens, also, that it is accompanied by another symptom, the nature of which would appear, at first sight, difficult to reconcile with the exclusive motor properties conceded to the seventh pair; I mean a singular alteration of the taste which is observed in the side of the tongue corresponding to that of the hemiplegia. This phenomenon has already been noticed by many observers, and the facts that we shall report will furnish new examples.

In this work our aim will be first to establish, by the aid of observations, the particular characters and the anatomical seat of the sensorial perversion which accompanies paralysis of the facial nerve; then to search the physiological explanation, in order to arrive at and determine the precise signification of this symptom in a pathological sense.

In a memoir,* published elsewhere, we have already reported five cases of facial paralysis with alteration of taste. Of these observa-

* Recherches anatomiques et physiologiques sur la corde du tympanum.

tions three were borrowed from the thesis of M. Montault, the two others appertain to us. Without reproducing these facts here, we will observe that they accord fully with those which follow.

Obs. I. (Taken from the hopital des Enfants Malades, and which I owe to the kindness of M. H. Guéneau de Mussy.)

Hourlier, (Henry,) aged 10 years, and of good constitution, entered the hopital des Enfants Malades the 16th of December 1843. As the context of an eruptive fever (rugeole) there supervened violent and deep seated pains in the right ear, which were diagnosticated by M. Mániére, consulted for the child, as symptoms of the formation of an abscess in the internal ear. In effect, a purulent discharge soon manifested itself, and the pain diminished in intensity. This discharge continued for twelve or fifteen days, and had almost ceased, when one morning, upon waking up, the child discovered that he spoke with more difficulty, and was unable to close the right eye. He called his mother, who, frightened by the deviation that she remarked in the face, carried the child directly to the hospital. (December 16th, 1843.) At this time the purulent discharge was reduced to a simple serous moisture. The sensibility of the whole face was preserved, but the loss of motion on the right side was complete. The features were drawn to the left side; the forehead without movement in the right half; inability to close the right eyelids; the right nostril remaining motionless and slightly depressed. The uvula and the tongue did not present any deviation, although there was some difficulty in pronouncing the labials. Observe what was remarked relative to *gustation:* when the tongue was drawn out of the mouth, and some sulphate of quinine or powdered salt was placed upon the surface of this organ, the taste of these substances was obtuse and slowly manifested on the right side, while it was strong and immediately perceived by the left. The 7th of January 1844, when I saw the patient with M. H. Guéneau de Mussy, all these symptoms still existed in a well marked degree. We observed that the surface of the tongue was equally moist on both sides, and offered no sensible difference in its aspect. When the mucous surface of the tongue was touched or pricked lightly, the tactile sensibility seemed equally exquisite upon both sides; it was only for the appreciation of sapid substances that there was a remarkable difference; thus, the mouth being open, if a little finely powdered citric acid was placed upon the right anterior surface of the tongue, its taste was feeble and required a very appreciable lapse of time to be felt; on the left side, on the contrary, its taste was penetrating and instantaneous. From the 20th of January the exterior symptoms of facial paralysis diminished, and the difference in the gustative sensibility progressively disappeared. The last phenomenon seemed even to disappear more rapidly than the others, for the difference in the taste was not appreciable, even while there existed a slight deviation in the features. The 18th of February 1844, the patient was discharged perfectly cured.

Obs. II. (Taken from the service of M. Rayer, at La Charité.)

Louis Gauvin, aged 35 years, a locksmith, entered La Charité the 29th of June 1843. In October 1841, after having suffered from cough and spitting of blood for some time, the patient was attacked with a slight purulent discharge from the left ear. In May 1842 the left face, and the eye in particular, became the seat of a red and painful tumefaction, accompanied with a chill. This catalogue of symptoms terminated by the rupture of an abscess which discharged by the external meatus. Henceforth the discharge from the ear was very abundant, and one day, according to the patient, there was discharged with the pus a small bone presenting two

teeth and a small rounded head; when I blew my nose, added he, it seemed as if air passed through the ear. The 3d of March 1843, the discharge from the ear still continuing, the patient was seized with intense and deep seated pains in the organ of hearing, which relented at the end of three or four days, but left in their place paralysis in the whole left side of the face. These are the principal symptoms the patient suffered out of the hospital; when he entered there the 29th of June 1843, an advanced stage of pulmonary tuberculosis was observable. We wish to occupy ourselves only with the phenomena of the facial hemiplegia; the deviation of the features and the loss of motion on the left side of the face was complete, but the sensibility remained intact. The eyelids could not be closed; the vision in the eye of the paralysed side remained unaffected, though there was sometimes a slight epiphora. The hearing was totally gone on the left side, and the purulent discharge continued abundant. The movements of the tongue were free, and no deviation in the uvula; there was a difficulty in pronouncing labials. The *gustation* presented a remarkable difference between the right and left side of the tongue. When the sulphate of quinine was placed upon the left side, for example, its taste was feeble, and required a certain time to be perceived, while upon the right side the patient recognised and appreciated it instantly. These observations made by M. Rayer were repeated frequently by this distinguished physician before the persons who followed his course. The facial paralysis was attributed to a lesion of the seventh pair consequent upon a tuberculous affection of the internal ear. During the whole time the patient spent in the hospital the purulent discharge from the ear continued, and there was no change in the phenomena relative to the facial hemiplegia, except a tumour, small, elongated, and painful to the touch, which made its appearance in front of the external meatus. The symptoms of pulmonary pthisis continued to increase, and the 15th of December 1843 the patient died.

Autopsy.—The lungs presented immense caverns; all the bronchial and cervical glands were engorged with tuberculous matter. The little tumour which developed itself in front of the meatus of the left ear was due to an alteration of this sort. At the request of M. Rayer, I sought with much care the pathological alterations relative to the left facial nerve. Upon opening the cranium, and after having raised the brain, I discovered on the left side, upon the dura-mater which covers the external and superior face of the petrous bone, a solution of continuity of a rounded form, and about two centimetres in extent. At this denuded point the osseous substance of the bone was visible; the portion which corresponded to the superior part of the internal ear was hard and necrosed, while lower down at the proximity of the Fallopian tube, the petrous bone friable and infiltrated with softened tuberculous matter, permitted a stylet to be passed through its substance into the cavity of the tympanum. The corresponding part of the middle lobe of the brain participated in these alterations, and showed a loss of substance of the same size, excavated in the form of ulceration, three millimetres in depth, with a yellow, indurated base. Around the circumference of this loss of cerebral substance the meninges of the brain had contracted adhesions with the edges of the petrous portion of the dura-mater, and in this way the pus from the circumscribed abscess discharged by the internal ear. The seventh pair of nerves was altered from towards its origin: at its entrance into the internal auditory meatus it presented upon its course a small, whitish, ovoid tumour, visible from the interior of the cranium. This little tumour was due to tuberculous matter infiltrated under the nurilema. In following with precaution the facial nerve in the spiral canal of the petrous bone, it was swollen, yellowish, and presented the same tuberculous degeneration nearly up to its first bending. But at this point the nerve was lost and disappeared in the midst of the softened tuberculous mass which, destroying the internal ear, disseminated itself far into the

mastoid cells, disorganised and filled with pus. After a careful examination of the bone, I was induced to think that it was the starting point of the affection which had propagated itself into the cranium by the Fallopian hiatus, and towards the origin of the nerve by the internal auditory canal. The facial, we have observed, had completely disappeared in the deep seated alterations; and it was only towards the inferior extremity of the Fallopian canal that its altered and swollen extremities could be found; in such a manner that, in all its petrous portion, this nerve was degenerated or disorganised by suppuration. The branches of the trigeminus, and the lingual nerve in particular, were examined with care, but no lesion was discovered. Neither the salivary glands nor their ducts presented any alteration on either the right or left side.

Obs. III. (Taken from the service of Professor Chomel at the Hotel-Dieu, and communicated by M. Barthez.)

Lagarde, aged 37 years, entered the Hotel-Dieu the 20th of February 1844. The 17th of the same month, without any known cause, and without any change in the general health, he felt a sort of numbness in the tongue, which seemed to him larger and heavier than ordinary. Neither the speech nor the deglutition were affected, but the patient observed with surprise that he could only perceive the taste of his food upon the right side. "To assure myself," said he, "that I was not deceived, I placed a mixture of mustard and salt upon the left side of my tongue and could scarcely taste it, while, when placed upon the right side, I was conscious of all its pungency." The 18th of February the symptoms were the same, only that the left eye became affected with a slight epiphora and the sensation of a deep seated throbbing. The patient slept very well during the night, but upon awaking the next morning (February 19th) he found that his mouth was distorted. With reference to gustation the same phenomena persisted, and he had a bleeding from the nose the same day. The 20th of February he entered the hospital, and the next day the following symptoms were noticed. The muscles were drawn to the right side of the face, with loss of motion on the left side, though the sensibility on both sides was retained. The left eye could only be imperfectly closed; the patient could not whistle or smoke. During mastication the food accumulated between the teeth and the left jaw. Speech and deglutition remained undisturbed, and there was no deviation in the tongue or uvula. The *gustatory sensibility* was tried with common salt and alum, and found unequal on the two sides of the tongue, being much more pronounced on the right than the left. The general state of the patient remained excellent; he had a good appetite; slept well; and had no headache, etc. No pain or contusion could be discovered in the course of the left facial nerve. From the 23d of February all the symptoms of paralysis above enumerated mended and gradually disappeared under the use of blisters.

Obs. IV. (Taken from the service of M. Velpeau.)

Broton, (André,) aged 45 years, entered La Charite hospital the 25th of May 1843. The 24th of May the patient had a fall from the first story of a house. He struck upon his head, causing a loss of consciousness, a wound upon the left side of the head, and a slight discharge of blood from the ear of the same side. Venesection was practiced directly after the fall, and the patient carried to the hospital, where he did not recover his consciousness until the next morning, (May 25th.) At the visit of the morning the following symptoms were observed: paralysis of the left side of the face, and the patient complaining of intense pain in the left side of the head; M. Velpeau diagnosticated it fracture of the petrous portion of the

temporal bone. The critical state of the patient would not admit of my making a detailed examination of the symptoms of the facial hemiplegia at this time. In a few days, under a well regulated treatment, the cerebral complications had disappeared, the wound on the side of the head had healed, the headache gone; but the facial paralysis was complete and persisted with the same intensity. On the left side the frontal muscles were motionless, the eyelids could not be closed, the features were drawn to the right, the power of speech unembarrassed, and no deviation in the uvula. During mastication the food accumulated between the teeth and the jaw. The vision was preserved, and the hearing and smell not sensibly affected; but there was a remarkable difference in *gustation* on the two sides of the tongue, though confined to the anterior part. If citric or tartaric acid were placed upon this organ, their savour and acid character were promptly perceived upon the right side, while upon the left the taste of these substances was very feeble, and their nature could not be distinctly recognised. In spite of this inequality in the faculty of gustation, the aspect of the tongue was the same throughout, equally moist at all points, and the tactile sensibility equally exquisite on both sides. The facial paralysis was slightly ameliorated by the use of blisters and galvanism, and the 14th of June 1843 the patient desired to quit the hospital, being perfectly established in his general health, but leaving with the paralysis uncured.

After these observations made upon the human subject, we can ascribe to the alteration of taste consequent upon facial hemiplegia, the decided symptoms which appertain to it. In the first place, as to its nature, it is seen that it is not a complete abolition of gustation, but a simple diminution and sort of perversion in this faculty, which, having lost its instantaneousness, presents a remarkable slowness in its manifestation. It is to be observed, also, that this sensorial modification is independent of the tactile sensibility of the mucous surface of the tongue which does not suffer any diminution. In relation to its seat, the alteration of taste, limited to the anterior two thirds of the tongue, only manifests itself upon the half of the tongue which corresponds to the hemiplegic side. And as a main character, it follows exactly the march of the other symptoms of the facial paralysis, since it appears and disappears *pari passu* with them. These symptoms will always serve to distinguish the alteration of taste due to the influence of the facial nerve from that which might depend upon a concomitant lesion of the fifth pair. Thus it is unquestionable that it is in a lesion of the facial nerve that we must search for the anatomical reason for the alteration of taste of which we are now treating. Anatomically speaking, there is but one branch of the facial nerve which can be invoked for this explanation; this is the chorda tympani which, after traversing its singular course through the internal ear, unites and confounds itself with the lingual nerve. The experiments upon living animals are demonstrative in this respect. If the facial nerve of a dog be cut above the origin of the chorda tympani, or if this nervous filament is isolated by seizing it in its passage through the internal ear by means of a small crochet introduced by the external meatus, you can determine with the animal the same gustative diminution, with the characters above described.

Without reconsidering the experiments of this nature which we have reported at length elsewhere, we will limit ourselves to referring

to their results in regard to the pathological phenomena observed in man. From the summary of these facts, we think we can infer with certainty, 1st, that the alteration of taste will be wanting in facial hemiplegia whenever the paralysing cause, whatever it may be, affects the facial nerve below the emergence of the chorda tympani in such a way as not to compromise the action of this nervous filament; 2d, that the sensorial symptom, on the contrary, will constantly exist when the paralysing cause is seated sufficiently high in the course of the seventh pair to destroy the function of the chorda tympani. We understand then that all the causes of facial paralysis which have their seat or point of departure in the internal ear must necessarily compromise this nervous thread and produce the alteration of taste; the observations 1, 2 and 3 furnish examples of this kind. Thus pathology and physiology accord in explaining how we may have facial paralysis with or without alteration of taste, according as the chorda tympani is implicated or not. Moreover, as the tympanitic branch is free and isolated in its passage through the cavity of the tympanum, it may be conceived that certain causes, traumatic or others, destroying or isolating this nerve, may produce only perversion of taste, without any symptom of facial paralysis. This fact may be easily proved by experiment upon the living animal.

But another extremely interesting question presents itself for solution in relation to the theory of the functions of the facial nerve; it is to know by what mechanism the chorda tympani, a branch of the facial, can influence the sense of taste. In this respect the discrepancies among authors are very great.

Bellingeri, entertaining an erroneous principle upon the functional nature of the seventh pair, admits that the chorda tympani is a sensitive branch of the facial which is distributed to the tongue and charged with transmitting gustatory impressions to the brain.

Arnold, regarding the facial as a motor nerve, admits that the chorda tympani, after simply running in company with the lingual nerve to the submaxillary ganglion, divides into two portions, the smaller one accompanying the lingual nerve to the tongue, the other, being larger, going to the submaxillary ganglion. It would be to the influence of this last filament, considered as a motor root of the ganglion, that the duct of Wharton owes its contractility in excreting the saliva into the buccal cavity.

M. Longet attributes the alteration of taste in facial hemiplegia to two causes: 1st. That the side of the tongue corresponding to the paralysed jaw is in contact with a smaller number of sapid molecules; 2d. To a slight desiccation of the tongue which would result from a discharge of saliva by the labial commissure. M. Longet thinks like Arnold relative to the anatomical disposition of the chorda tympani, and expresses himself thus with reference to its functional nature: "I have said that independently of the muscular arrangement surrounding the buccal orifice, which acts in pronunciation, sputation, suction, etc., I admitted a deep seated contractility represented by the excretory ducts of the salivary glands; these parts under certain circumstances are similar to the iris. When a very sapid substance is placed in contact with the mucous membrane of the tongue, it is

known that the salivary secretion becomes abundant, in order to lessen the too stimulating action of such substance, as in the eye a protecting contraction of the iris takes place to defend that organ against light. The saliva flows through ducts whose contractile force ought to increase in proportion to the amount of saliva secreted, and it is worthy of remark, if the iris and certain muscles of the veil of the palate are animated by filaments which coming from the motor oculi and the facial traverse first the ophthalmic, otic and spheno-palatine ganglia, in the same way the excretory salivary ducts owe their contractility to filaments which traverse the submaxillary and parotid ganglia. The mode of nervous distribution seems to establish here some resemblance; then, in considering that the saliva is a liquid essential to the exercise and protection of the sense of taste, it is not pushing analogy to absurdity to say, that, within certain limits and under circumstances, the organs which secrete this fluid and those which conduct it to other organs influence the sense of taste, as the iris or the muscles of the veil of the palate assist in the exercise and protection of the sense of sight or smell."

It will be seen that M. Longet strives particularly to establish a certain order of secondary sensorial symptoms; and as he only gives a remote analogy in support of his notions of the functions of the chorda tympani, the demonstration is far from being satisfactory. In effect, if the proposed explanation of this nervous branch be admitted, the first thing to do would be to prove its action upon the salivary ducts, and to ascertain if, after paralysis, the saliva not arriving in the mouth, the surface of the tongue became really drier. The animals upon which complete facial paralysis has been practiced on both sides, presented the buccal mucous membrane as moist as ordinary, and the saliva, when induced in abundance by the application of an excitant, ran off by the paralysed commissures. We know, by the facts cited, that the same thing takes place in the human subject. Thus, observation proves that facial paralysis does not induce a dryness of the tongue, and supposing that it did, the alteration of taste could not, even by the theory of M. Longet, be attributed to it. In fact, the saliva, arriving in abundance, would dilute and lessen the impression of substances too strong, and thus, if the salivary flux is suspended on the side corresponding to the paralysis, and the surface less humid, it would result that the savours would be perceived more intensely upon this side than the other. But it will be recollected that in the alteration of taste consequent upon facial hemiplegia, all the observations prove an alteration of taste precisely inverse. The absence or presence of the salivary secretion, that nothing prevents flowing from one side to the other of the mouth, would not explain the constant locality of the perversion of taste which is always defined by the median line of the tongue; and for our part, this last fact of itself would suffice to prove that it is a modification of the mucous tissue of the tongue, and no irregularity in the distribution of liquids upon its surface. The anatomical hypothesis, therefore, of Arnold, upon which M. Longet rests his theory, does not seem to us to explain in a plausible manner the alteration of taste in facial hemiplegia.

Professor P. Bérard interprets ingeniously the alteration of taste which we are considering. "I do not maintain," says this author, "that the chorda tympani is absolutely without influence upon the sensibility of the tongue. M. Montault reports three cases of facial hemiplegia in which the taste, if not abolished, was at least perverted in the corresponding side of the tongue. Professor Roux, who some years ago had paralysis of the face, has told me that the sensibility of the tongue suffered some alteration. These facts," continues the same author, "seem completely opposed to the doctrine I profess, viz., that the seventh pair is a nerve of motion and not of sensation; but I recollect at the same time that the tympanic nerve, a branch of the facial, is reinforced by the Vidian nerve, a branch of the fifth pair, and is thus a nerve of sensation."

This explanation is in accordance with the nature of the phenomena observed, and would thus explain to a certain extent how the alteration of taste is a simple diminution and not a complete abolition of sensation. But the interpretation given by Professor Bérard necessarily conveys the idea, 1st, that the facial nerve has nothing to do with the alteration of taste; 2d, that this phenomenon is finally produced by the intermediation of the Vidian, a branch of the fifth pair, which constitutes one of the elements of the chorda tympani. Many anatomists, it is well known, do not admit this mixed composition of the chorda tympani, considering it as a branch coming exclusively from the facial. These questions, up to the present, have only been discussed by anatomical arguments; it seems to us they might have been examined experimentally. We have, upon dogs, cut the facial nerve above its junction with the Vidian, that is at its origin and where it enters with the acoustic into the internal meatus. Upon other animals of the same kind we have destroyed the facial in the midst of the internal ear, and necessarily below the insertion of the Vidian branch. In both cases the gustative alteration was equally manifested, although in the first experiment, as may be seen, the Vidian had been completely managed. From these experiments, often repeated, it does not seem possible to invoke the intervention of the Vidian nerve to explain perversion of taste, and on the other hand, observing that the chorda tympani is insensible to direct irritation, we contend that the Vidian has nothing to do with its formation; that the chorda tympani comes exclusively from the facial and presents the motor characters proper to the nerve from which it emanates. Thus then, following the natural deductions furnished by a critical analysis of pathological and physiological phenomena, we obtain in respect to the chorda tympani the following result: *It is a motor nervous branch coming from the facial, going to distribute itself to the mucous membrane of the tongue, and giving to this membrane the faculty to perceive, in a manner instantaneous and complete, the impression of savours.*

If this proposition is, as we think, the expression of facts, it will not be objected to, although it appear inexplicable by the theories admitted upon the properties of nerves. For the following considerations upon the mechanism of the gustatory perceptions will show that the action of the chorda tympani with reference to them can be perfectly comprehended. First, in examining the intimate texture of

the gustatory organ, it will be observed to be composed of many elements which, from without inwards are superposed in the following manner :* 1. Epithelium, which forms the most external layer; 2. The vascular network of papillæ; 3. Beneath this the nervous network formed by the distribution of the terminal sensorial nerves; 4. The fibrous layer. It will be understood now how, when sapid substances are placed upon the surface of the tongue, they ought necessarily, before arriving at the nerve charged with transmitting the impression to the cerebral centre, traverse the epithelium and vascular network. But as in a normal state the perception of savour is instantaneous, the transporting or absorption of the substance ought to be sudden; whilst, after the section of the chorda tympani, the sensation becoming slower, it must be admitted, in this case, that the transporting of the substance to the sensorial nerve is retarded. Thus the obliteration of the chorda tympani does not destroy the sense of taste properly speaking, which persists always, but modifies its manifestation by acting upon the papillæ which are the anatomical medium which nature has placed between the sapid substance and the organ charged with its appreciation. Now the mechanism of this secondary nervous influence will easily be understood when the phenomena which take place in the papillary tissue are known. The observations of M. Gruby have perfectly proved that, in the living state, the papillæ of the small intestines, for example, execute at the moment of the absorption of the chyle, incessant and rapid movements† of lengthening and shortening, which are the essential condition of an active and entire absorption. But in spite of the smallness of the papillæ of the mucous membrane, which prevents the discovery of distinct muscular fibres in them, it is impossible to understand these movements without admitting an influence coming from the motor nerves. For the tongue, the presence of these motor fibres in its membrane is indubitable, since the chorda tympani is seen to follow the lingual nerve quite to its extremity, and distribute itself in the anterior two thirds of the lingual mucous membrane.‡ Besides the physiological influence of these motor fibres can be perfectly appreciated; for when the chorda tympani is destroyed, the membrane of the tongue, which retains its sensibility, loses its activity or instantaneousness for gustative absorption, this function being considerably lessened and reduced to a sort of passive imbibition. For the mucous membrane of the stomach, the experiments of Muller and our own have proved that it was the same, and that absorption in the stomach is retarded by section of the par vagum.

Although these considerations seem to us new and interesting, inasmuch as they teach us that the motor nerves have a direct influence upon the active absorption of certain mucous membranes, we will not, however, push them farther; the developments that we have made convey sufficiently our idea of the mechanism of the perversion of taste in facial paralysis, and authorise us to conclude :

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* These observations are due to M. Gruby.

† These movements are very different from and are not to be confounded with the vibratory motion.

‡ See memoir already referred to.

That the chorda tympani which ramifies through the mucous membrane of the tongue ought to be considered as a motor nerve, charged by its action upon the papillary lingual tissue with regulating and rendering instantaneous the transportation of the sapid excitant to the sensorial nerve which appreciates it. In this respect the papillary network of the tongue is exactly analogous to the modifying arrangements which are placed between the other nerves of sense and their natural excitants.

The pathological consequences resulting from the facts of this memoir are easy to deduce. We will say, then, that the *alteration of taste*, with the characters which we have assigned to it, constitute one of the regular symptoms of paralysis of the seventh pair. We have established, in effect, that the sensorial modification is not caused by a nerve of sensation, but that it depends upon a special inertia of the gustatory organ, which does not receive the influence of the motor branch of the facial (chorda tympani) proper to it. When this symptom is wanting, the paralysis of the facial nerve is not complete. These cases can always be determined, since the gustative alteration will distinguish the complete hemiplegias, that is to say, those in which the lesion of the facial nerve is towards its origin, above the emergence of the chorda tympani. In consideration of these facts, we will advance the opinion that the alteration of taste is a frequent symptom of facial paralysis; and if this symptom has not been remarked oftener by pathologists, and is only regarded as exceptional, it is unquestionably because the functional disorders which characterise it are more difficult to appreciate than the loss of mobility in the face, and are often overlooked by the unsuspecting practitioner. The patients themselves are seldom aware, while eating, of this diminution of taste which only affects a limited portion of the tongue. It is necessary, in order to render the difference evident, to draw the tongue out of the mouth and test the sensibility of taste by placing a sapid substance upon the tongue and comparing its effects upon the healthy and hemiplegic side.